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ing simply moving flashes in tranquil incandescent gases. Neither of these theories, however, is accepted to any great extent by practical students of the Sun and observers of solar phenomena.

The surface of the Sun (photosphere, spots, faculæ and prominences) is now a subject of daily study at many observatories, particularly at Potsdam, Meudon, Rome, and the Kenwood Observatory of the University of Chicago, where Professor Hale has instituted many significant innovations, in which he has been closely followed by M. Deslandres, of Paris; and observations are rapidly accumulating, the complete discussion of which ought soon to settle many points in the solar theory now disputed. But as the Sun's corona is visible only a few hours in a century, our knowledge of that object makes haste very slowly, and must continue to do so, unless the photographic method of Dr. Huggins (apparently successful in 1883, though later not), or of other investigators, shall make it possible to study the brighter streamers of the corona without an eclipse. Results of a patient series of recent attempts, however, are not encouraging. But it is well worth noting that an application of Professor Langley's bolometer, lately proposed by Professor Hale, though not yet put into execution, may still enable us to map the corona at any time by means of the minute variations in its heat from part to part. And many astronomers are hopeful that this ingenious suggestion may yet give a trustworthy outline picture of the corona in full sunlight, although the ability to picture it directly may forever be denied.

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CURRENT NOTES ON PHYSIOGRAPHY (XII.).

RECENT GEOGRAPHICAL SCHOOL BOOKS.

PROFESSOR SPENCER TROTTER's 'Lessons in the New Geography' (Heath & Co., Boston, 1895) was referred to with approval

in the Current Notes on Anthropology in SCIENCE for March 8th; but its geographical features are not altogether satisfactory. The spirit of the book is excellent. It does a good work in emphasizing the control that geographical conditions exercise over the distribution of plants, animals and man; but its physiographic foundation is not secure; the two brief chapters on the general forms of land and water and on climate and meteorology do not present the better modern views on these subjects; and the chapters on the geographical distribution of life, to which special attention is paid, do not satisfy the expectations of the biologist, as far as I have made inquiry. The faunal divisions recognized for America belong to the past; while the latest results, based on positive knowledge of the facts of distribution and of the facts of temperature control, are not mentioned. It is to be hoped that these deficiencies will be corrected in a later edition.

'Short Studies in Nature Knowledge,' an introduction to the science of physiography by William Gee, certified teacher of the education department (London, Macmillan, 1895), is one of a class of attractive books, whose object is to make geography better worth studying. Its entertaining chapters are well illustrated, if exception is made of certain exaggerated pictures, such as that of the Susquehanna, p. 121; but the book lacks a strong and scientific basis. The reader will probably be interested and attracted to further study; but he will not be impressed with the system and order of Nature's processes. As is so often the case, the impossible is attempted in giving an elementary explanation of the general circulation of the winds.

'A Brief Descriptive Geography of the Empire State,' by C. W. Bardeen (Bardeen, Syracuse, N. Y., 1895, 75 cents), is intended for local use, giving an account of the general topography, surface (mountains,

rivers, lakes, waterfalls, etc.), geology, climate and productions, political divisions, education, and railway journeys; the latter heading occupying a third of the book. There are numerous illustrations, many of which are well chosen and well produced. Twenty-five small outline maps are used to exhibit the distribution of various features. Yet, on the whole, the book is an empirical treatment of a rational subject. Not nearly enough is made of the physical features of the State, as to their origin on the one hand, and as to their control over conditions of life on the other hand. The attitude of the author regarding physiographic processes may be judged from an extract: "The valleys [of the Finger Lakes] seem like immense ravines, formed by some tremendous force, which has torn the solid rocks from their original beds;" a foot note adding—"The force that effected these immense changes was probably great currents of water from the N." The disregard of geological structure as a basis of geographical subdivision is indicated by the following: "Three distinct mountain masses or ranges enter the State from the S. and extend across it in a general NE. direction." Then after accounts of the Highlands and the Catskills we read: "*The Adirondacks*.—The third series of mountains enters the State from Pennsylvania and extends NE. through Broome * * * * and Herkimer counties to the Mohawk, appears upon the N. side of that river, and extends NE., forming the whole series of highlands that occupy the NE. part of the State, generally known as the Adirondack Mountain region" (p. 19). This association of a part of the sedimentary Allegheny plateau with the crystalline Adirondacks is altogether unwarrantable, especially as the two are separated by a well defined subsequent lowland.

A common difficulty pervades these three books; they are not based on a serious, thorough, scientific study of geography.

TEAY VALLEY, WEST VIRGINIA.

THE topographical sheets of the U. S. Geological Survey for West Virginia include the path of Teay Valley, a wide-open, clay-floored trench running east and west through the hilly plateau, from the Kanawha Valley a little below Big Coal River, to the Ohio Valley a little above Huntington, but not followed by any proportionate stream. It has been stated that 'the valley is clearly enough a remnant of early erosion, when the water of the Upper Kanawha took that course to join the Ohio' (Wright, Bull. 58, U. S. G. S., 87); but this is not satisfactory, for if the master stream of the region ever followed this course, how was it ever diverted to any other course? The following alternative explanation is offered, in the hope that it may be criticized by special observation on the ground.

The diversion of one stream by another flowing in the same general direction in a region of horizontal strata is comparatively rare; if it happens, it is usually the result of the lateral swinging of a larger toward a smaller one. At the moment of contact, the larger one, which has the lower grade, laterally abstracts the smaller one, which has the higher grade. The Cumberland in western Kentucky is in some danger of this sort of abstraction by the Tennessee, and if that region were now uplifted, the abstraction might easily result from the increased lateral meandering that would be there introduced. Lateral abstraction seems to have been actually practised on the Big Coal River by the Kanawha; Teay Valley being the lower abandoned course formerly followed by the Big Coal. In France, crystalline pebbles carried by the Moselle from the Vosges mountains into the valley of the Meuse show plainly enough a former arrangement of drainage unlike the present; but the monotonous sandstones of the Alleghany plateau in the Kanawha and Big Coal River basins pro-

bably forbid the application of this test to the case of the Teay Valley. Can any other test be suggested?

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ZOOLOGICAL NOTES.

A MONOGRAPH OF CRINOIDS.*

THE crinoids of the Paleozoic rocks of North America are so rich and varied in form, so numerous in individuals, that they have long been the delight and the despair of naturalists. Especially is this the case with that order of the crinoids to which the name Camerata is now generally applied, the order that includes such well-known forms as the Nava Encrinite, *Actinocrinus*, and the Rose Encrinite, *Rhodocrinus*, which are common enough in our own Mountain Limestone, together with the flatter and simpler form, *Platycrinus*. For, in America, there are added to these ordinary genera such remarkable creatures as the huge *Megistocrinus*; the speared and spined *Dorycrinus*; the peculiar mushroom-like *Agaricocrinus*; *Strotocrinus*, like a college don in his mortar-board; *Eretmocrinus*, with its broad oar-like arms; *Pterotocrinus*, whose lofty dome is surmounted by wings; *Gilbertocrinus*, with strange drooping appendages of unknown function, and *Batocrinus*, whose pores at the bases of the arms are equally mysterious. But this list does not include a quarter of the camerate or vaulted genera known from the Carboniferous rocks of America alone; while, if we accept the work of Mr. S. A. Miller and kindred spirits, the long line will stretch out to the crack of doom. Such, indeed, is the variety of form, and such the rashness of interpretation of some of the more enthusiastic collectors and describers, that to us European students the subject has become one of in-

extricable complexity. It is, therefore, with peculiar pleasure that we learn an authoritative monograph of these wonderful and beautiful beings is shortly to be issued.

Since the year 1859, or thereby, Charles Wachsmuth, who lives at Burlington, Iowa, in the very heart of the crinoid country, has devoted his life to the study of these animals. A large collection which he made was bought for the Museum at Cambridge, Mass., by Professor Louis Agassiz, at whose invitation Wachsmuth settled at the University to take charge of the whole collection of crinoids. The first-fruits of his study were published in 1877. After a time Wachsmuth returned to Burlington and began to form a second collection; much of this he was, unfortunately for himself, forced to part with, this time to the enrichment of the British Museum, in whose galleries some of his magnificent specimens are displayed. Association with Frank Springer enabled him to continue his collection and his studies, so that the series of fossil crinoidæ made by the two friends is unrivalled even by the great collections of London, Harvard or Stockholm, and their 'Revision of the Paleozoic Crinoids' has long held the front rank among all works on the subject. In their knowledge of the writings of others, in their accurate discrimination of generic and specific characters, and in their important contributions to the morphology of the crinoids, these gentlemen have shown themselves most fitted to prepare that desired necessity, a monograph of the fossil crinoids of North America. The magnitude of the task, the failing health of the elder worker and the business cares of the younger, have prevented the completion of more than a portion, that, namely, which deals with the Crinoidæ Camerata. The text of this portion alone will fill between 600 and 700 quarto pages, while no less than eighty-three plates, of extreme beauty, have been drawn by A. M. Westergren, J.

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